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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/521,086	01/09/2006	Frederick Marcel Van Der Vliet	GEML 4793-3	4507

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GEMFIRE c/o HAYNES BEFFEL & WOLFELD LLP  
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EXAMINER
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ANDERSON, GUY G

ART UNIT	PAPER NUMBER
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2883

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/26/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

## Office Action Summary

**Application No.**

10/521,086

**Applicant(s)**VAN DER VLIET, FREDERICK  
MARCEL**Examiner**

Guy G. Anderson

**Art Unit**

2883

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 31 January 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-9, 13 and 15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9, 13 and 15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 October 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>3/6/2007</u> . | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Continued Examination Under 37 CFR 1.114*

- 1.1 A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3/6/2007 has been entered.

### *Response to Arguments*

- 2.1 Applicant's arguments, see RCE filed March 6, 2007, with respect to examiners objections under 35 U.S.C. 132(a) for the addition of new matter relating to a change in a mathematical equation in the previous Amendment, applicants arguments/explanations have been fully considered and are persuasive. The objection to new matter has been withdrawn.
- 2.2 Regarding the objection to claim 5 for the use of the term 'substantially' as being non-limiting, applicant has amended the claim and deleted this word. Therefore, the objection is withdrawn.
- 2.3 Applicant's arguments with respect to the rejections under 35 U.S.C. 102(e) and 103(a) of claims 1-9 and 13-14 have been considered but are moot in view of the new ground(s) of rejection. Applicant has canceled claim 14.

### *Response to Amendment*

### *Claim Rejections - 35 USC § 103*

- 3.1 The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:
- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.
- 3.2 **Claim 1 is rejected under 35 U.S.C. 103(a)** as being unpatentable over US-6768842 to Bulthuis.

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**Regarding claim 1**, Bulthuis specifically discloses an arrayed waveguide grating comprising/wherein:

1a) a substantially single-mode input waveguide; at least two output waveguides; and a non-adiabatic tapered waveguide optically coupled between the input waveguide and the output waveguides; said waveguides being formed on a substrate; wherein the non-adiabatic tapered waveguide, along at least a portion of its length, widens in width towards the output waveguides, in a plane parallel to the substrate, and the non-adiabatic tapered waveguide merges substantially continuously with the input waveguide in a direction parallel to the optical axis of the input waveguide.

[Bulthuis at Fig.1- 9, Col. 2, Lines 9-45, Col. 9, Lines 1-35.]

Bulthuis does not specifically disclose a structure wherein:

1b) the non-adiabatic tapered waveguide has a shape that forms a double-peaked field at the junction between the tapered waveguide and the output waveguides, each of the peaks entering a respective one of the output waveguides.

However, Bulthuis notes at Col. 2, lines 10-55, that non-adiabatic waveguides are well known devices used for near field shaping which creates a double peaked mode field. Bulthuis also discloses in the same cited passage the use of parabolic shaped horns or tapers to form a double peaked field and goes on to say that other non-adiabatic shapes such as a curvilinear shape based on a cosine curve can also be used to achieve this double peaked mode field.

[Bulthuis at Col. 2, lines 30-44.]

Therefore, the methods and structures claimed by applicant were well known in the art at the time of invention and it would have been obvious for one of ordinary skill in the art at the time of invention to have combined the teachings in Bulthuis with the design of Bulthuis in order to design a splitter with a flat passband that had a double peaked mode field at the output waveguides.

3.3 **Claim 13 and 15 are rejected under 35 U.S.C. 103(a)** as being unpatentable over US-6768842 to Bulthuis. Bulthuis discloses or makes obvious all of the limitations of the base claims upon which Claims 13 and 15 depend.

**Regarding claims 13 and 15**, Bulthuis specifically discloses:

13) the non-adiabatic tapered waveguide has a shape in a plane parallel to the substrate that excites a second order mode therein but substantially no mode higher than the second order mode.

[Bulthuis at Fig.1- 9, Col. 2, Lines 9-45, Col. 9, Lines 1-35.]

15) wherein the first and second output waveguides are separated from each other transversely by a blunt, and wherein the multi-peaked field has a local intensity minimum at the blunt. [Bulthuis at Fig.1- 9, Col. 2, Lines 9-45, Col. 9, Lines 1-35, particularly Fig. 2.]

3.4 **Claim 2-8 are rejected under 35 U.S.C. 103(a)** as being unpatentable over US-6768842 to Bulthuis in further view of Bouda in US-6643432 and in further view Laurent-Lund in US-2005/0207705. Bulthuis or the combination of Bulthuis, Bouda, and Laurent-Lund discloses or makes obvious all of the limitations of the base claims upon which Claims 2-8 depend.

**Regarding claim 2**, Bulthuis does not specifically disclose:

2) at least an initial portion of the non-adiabatic tapered waveguide proximal to the input waveguide has a taper angle which increases towards the output waveguides.

However, this limitation is taught by Laurent-Lund. [Fig.10 and Paragraph 81.] Therefore, it would have been obvious to one who was skilled in the art at the time of invention to combine the non-adiabatic tapered waveguide of Bulthuis with the non-linear waveguide of Laurent-Lund in order to provide a homogenous distribution of power between the output waveguides [Laurent-Lund at Paragraph 81.]

**Regarding claim 3**, Bulthuis does not specifically disclose:

3) the non-adiabatic waveguide tapers gradually so as to excite a second order mode therein.

Bouda discloses these limitations as a means to support a certain number of discrete modes. [Col. 4, Lines 44-50.]

Since Bouda, Laurent-Lund and Bulthuis are all from the same field of endeavor, the structure of Bouda would have been recognized as being in the pertinent art of Bulthuis. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to combine the structure of Bouda with Bulthuis in order to support a discreet number of modes.

**Regarding claim 4**, Bulthuis does not specifically disclose:

- 4) the length of the non-adiabatic tapered waveguide, in a direction parallel to the direction of propagation of an optical signal therein, is such that the phase difference between the fundamental and second order modes, at an output end of the non-adiabatic tapered waveguide is equal to  $M\pi$  where  $M=1,3,5,\dots$

However, it is well known in the art that by changing the length of the waveguide, a designer may introduce a  $\pi$  phase difference at the output between fundamental and higher order modes denoted by  $M=0, 1, 2, 3, \dots$  [For related art see Bae, US-6728438.]

Therefore, it would have been obvious to one who was skilled in the art at the time of invention to design the length of the waveguide such that a phase difference between the fundamental and second order modes was achieved so as to provide for an homogenous distribution of power at the output. [See Laurent-Lund at Paragraph 81.]

**Regarding claim 5**, Bulthuis does not specifically disclose:

- 5) the non adiabatic tapered waveguide tapers symmetrically with respect to the direction of propagation of an optical signal therein.

Both Bouda and Laurent-Lund specifically disclose this limitation as a means to provide lower order modes couple into higher order modes. [See Bouda Fig. 1 and Laurent-Lund Fig. 10.]

Since Bouda and Laurent-Lund are from the same field of endeavor as Bulthuis, their structures would have been recognized as being in the pertinent art of Bulthuis.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to combine the structures of Bouda and Laurent-Lund with the structure of Bulthuis as a means to couple lower order modes into higher order modes.

**Regarding claim 6**, Bulthuis does not specifically disclose:

- 6) the non-adiabatic tapered waveguide has opposing tapered sides each having a taper shape (Fig. 1) **(based on a perturbed cosine function)**.

The examiner gives no patentable weight to the highlighted limitation “perturbed cosine function” as it is a function and not a product limitation.

Bouda specifically discloses this limitation as a means to couple lower order modes into higher order modes. [Fig. 1]

Since Bouda is from the same field of endeavor as Bulthuis, the structure of Bouda would have been recognized as being in the pertinent art of Bulthuis.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to combine the structure of Bouda with the structure of Bulthuis as a means to couple lower order modes into higher order modes.

**Regarding claim 7**, Bulthuis does not specifically disclose:

7) said output waveguides are substantially single mode.

The examiner gives no patentable weight to the term 'substantially single mode' because applicants own definition of 'substantially single mode' in the disclosure allows for the waveguides to be multi mode as long as no significant signal is effectively carried by the higher order modes. Additionally, single mode output waveguides are well known in the art. [See Ido in US-6236784, where the output waveguides have the same physical width as the single mode input waveguide in Fig. 1 and 2.]

**Regarding claim 8**, Bulthuis does not specifically disclose:

8) at least one of the output waveguides has an adiabatically tapered end which is connected to an output end of the non-adiabatic tapered waveguide and which widens in width towards the non-adiabatic tapered waveguide.

However, Bouda specifically discloses prior art star couplers where tapers are provided at each of the output waveguides. [Col. 2, lines 27-36.] Since Bouda is from the same field of endeavor as Bulthuis, the structure and disclosure of Bouda would have been recognized as being in the pertinent art of Bulthuis.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to provide the invention of Bulthuis and Bouda with tapered output waveguides in order to obtain uniformity in the optical coupling at the output ports [Col. 2, Lines 27-36.]

For related art see McGreer in US-2002/0159703.

3.5 **Claim 9 is rejected** under 35 U.S.C. 103(a) as being unpatentable over US-6768842 to Bulthuis in view of Bouda in US-6643432 in further view of Laurent-Lund in US-2005/0207705 and in further view of Li in US-5745619.

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- 3.6 **Regarding Claim 9**, the combination of Bulthuis, Bouda and Laurent-Lund teaches all of the limitations of the base claims upon which Claim 9 depends. However, the combination of Bulthuis, Bouda and Laurent-Lund does not disclose a splitter comprising:

9) wherein there is a gap between an output end of the non-adiabatic tapered waveguide and respective ends of the output waveguides optically coupled thereto.

However, Li specifically discloses an embodiment whereby a transverse gap isolates the output waveguides. [Fig. 6E, Col. 7, Lines 25-40.] Therefore, it would have been obvious to one who was skilled in the art at the time of invention to provide the combination of Bulthuis, Bouda and Laurent-Lund with a transverse gap between the tapered waveguide and output waveguides in order allow for the signals to act more predictably given the practical manufacturing tolerances in the current environment [Li at Col. 7, Lines 25-40.]

### *Conclusion*

- 4.1 The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

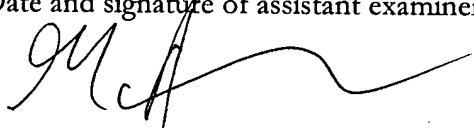
Patent Number/Identifier	Name	Relevancy
US-20020159703	McGreer	Non Linear Tapered waveguides
US-6236784	Ido	Y branching waveguide
US-6222966	Khan	Adiabatic waveguide with chirp control
US-6553164	Ono	Y branch waveguide
US-6728438	Bae	Control of mode conversion
US-6633703	Katayama	Tapered waveguides

- 4.2 Any inquiry concerning this communication or earlier communications from the examiner should be directed to Guy G. Anderson whose telephone number is 571.272.8045. The examiner can normally be reached on Tuesday-Saturday 0900-2200.



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- 4.3 If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Frank Font can be reached on 571.272.2415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.
- 4.4 Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.
- 4.5 Date and signature of assistant examiner.



March 17, 2007



Frank G. Font  
Supervisory Patent Examiner  
Technology Center 2800